

## Robotics in Healthcare

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### ABSTRACT

For a long time, robots have been used in the healthcare industry, mostly behind the scenes. In hospitals, the spectrum of robotic applications has significantly increased over the last five years to include helpful applications for doctors, nurses, and patients. In medicine, robots assist by removing routine duties from medical personnel's schedules, allowing them to focus on more important activities, and by making medical treatments safer and less expensive for patients. They can also do precise surgery in small spaces and transport hazardous materials.

**Keywords:** Healthcare sector, Robotics, Technology, Blu Ocean Innovations Private Limited.

### 1. Introduction

Innovative technology has enabled further advancements in limited access surgery since the dawn of the twenty-first century. Robotic surgery and telepresence surgery have revolutionized minimum access surgery by efficiently addressing the restrictions of laparoscopic and thoracoscopic techniques [2]. Robotic surgery is projected to become a larger feature of surgery in the future [3]. "In the future, practically all surgery can and will be conducted by robots" according to the researchers. As a result, robotic surgery will not only necessitate specialized training, but it will also alter current surgical training patterns and modify residents' learning curves by providing new options like as robotic surgical simulations and robotic telementoring [4].

Robotics is being used in a variety of settings that have a direct impact on patient care. They can be used to disinfect patient rooms and operating rooms, lowering the risk of infection for both patients and medical staff [5]-[6]. They work in laboratories, collecting samples, transporting, analyzing, and storing them. If you've ever had blood drawn by someone who had to attempt multiple times to find a "good vein," this is really wonderful news. The patient will experience less discomfort and worry when the robotic lab assistant locates that vessel and draws blood. In pharmaceutical labs, robots also prepare and deliver drugs. Robotic carts transport bed linens and even meals from floor to floor in larger facilities, riding elevators and maneuvering through automatic doors.

### 2. Literature Review

Many researchers have focused on inventing and constructing sophisticated healthcare robots using new technology. Artificial intelligence, the Internet of Things, computer vision, and other technologies are used by these robots. We have quoted the specifics of numerous healthcare robots that have been built in this area and highlighted the essential aspects of this developed healthcare robot. In the medical setting, healthcare robots can perform a variety of tasks. Hossain et al., have proposed ADIO, an assistant robot that helps to reduce person-to-person contact while keeping an eye on cleanliness. Additionally, the robot can administer medication, perform automatic sanitization, and monitor fundamental metrics like as temperature, heart rate, and oxygen saturation level using an Android app to keep track of the database.

The system was implemented using a variety of machine learning and AI approaches. Huang et al., presented their work on a health examination robot that checks height, blood pressure, cholesterol level, body weight, oxygen level, glucose level, ECG, and energy consumption to monitor patients' health. The information is then sent to the central control systems for analysis and printing. Kuo et al., have also introduced a robot that is mostly used to check vital signs. It can identify disease and issue an alarm in the event of an emergency, as well as provide long-term monitoring through data and event logging.

The major goal was to create a robot that could work in the presence of humans and provide vital sign monitoring in hospitals. It's also suitable for usage in nursing homes and for personal care. The major goal of this project is to integrate all medical indicators such as vital sign monitoring, such as SpO<sub>2</sub>, body temperature, blood pressure, pulse rate, and galvanic skin response. The second is to create a welcoming environment and maintain two-way connection with the user. Furthermore, throughout patient treatment, healthcare staff must keep track of numerous health factors. Tasaki et al., have created the most up-to-date form of robot that helps healthcare professionals make therapeutic rounds in patients' rooms in hospitals.

This robot primarily does two tasks: it completes all of the required methods and approaches on the rounds as a practitioner and storing all healthcare-related data. It has Omni-directional portable wheels and a human tracking control structure that medical practitioners can employ as a helper. All health-related data is automatically recorded with the help of the camera and recorder. The ability to communicate with humans and change facial emotions is the major feature that distinguishes this robot.

### **3. Robots in Medicine and Healthcare**

#### ***3.1. Medical Device Packaging***

Medical devices present packaging robots with some unique obstacles. Sterilization is required, for example, for gadgets that will come into touch with people. When humans do such packaging chores, there is a substantial risk of contamination, jeopardizing the items' integrity.

Robots are an excellent approach to lower - or perhaps eliminate - the risk of contamination. They are capable of doing packing activities that necessitate a totally sterile environment.

#### ***3.2. Lab Automation***

Lab automation is another robotic use with apparent healthcare benefits. A significant number of tests are performed every day in medical labs all over the world. According to the British Medical Journal, over 277 million blood tests were requested in the UK alone in 2014. These tests necessitate a lot of repetitive movements, making them an excellent choice for robot automation!

#### ***3.3. Surgical Assistants***

These remote-controlled robots help surgeons carry out operations that are normally minimally invasive. More improved 3DHD technology gives doctors the spatial references needed for very intricate surgery, including more enhanced natural stereo viewing paired with augmented reality, thus new uses for these surgical-assistant robots are always being developed.

### ***3.4. Rehabilitation Robots***

These are important in the recovery of people with impairments, since they increase mobility, strength, coordination, and overall quality of life. As patients recover from strokes, traumatic brain or spinal cord injuries, or neurobehavioral or neuromuscular illnesses like multiple sclerosis, these robots can be trained to adapt to their condition. Balance, walking, and other motor functions can all benefit from virtual reality combined with rehabilitation robots.

### ***3.5. Transportation Robots***

These robots transport supplies, drugs, and food to patients and workers, allowing doctors, hospital staff, and patients to communicate more effectively. The majority of these equipment have highly focused self-navigation skills across the facility. However, in order to improve the navigational capabilities of transportation robots, highly advanced and cost-effective indoor navigation systems based on sensor fusion location technology are required.

### ***3.6. Sanitation and Disinfection Robots***

With the rise of antibiotic-resistant bacteria and outbreaks of lethal illnesses such as Ebola, more healthcare facilities are turning to robotic cleaning and disinfection. UV light and hydrogen peroxide vapors are currently the most common disinfection treatments. Within minutes, these robots can sanitize a room of any bacteria or viruses.

### ***3.7. Robotic Prescription dispensing***

The most significant advantages of robots are speed and accuracy, both of which are critical in pharmacies. Robots can now handle powders, liquids, and highly viscous materials with far more speed and accuracy than before.

## **4. Future Scope**

We should anticipate in seeing growing use of robots throughout the healthcare spectrum as the range of jobs done by both collaborative and mobile robots expands. We can expect an increase in robots for duties that do not require considerable interaction with physicians, nurses, or patients in the short to medium future, such as collecting and transporting goods and drugs. As software algorithms advance, we will witness more robot-to-human interaction in the long run. Intelligent assistants for care homes, for example, are being developed to detect if someone needs water and serve them if they don't, as well as provide entertainment and aid careers.

In order for robots to understand and respond appropriately to their surroundings, these activities necessitate complicated software algorithms. However, because to the technical complexity of these applications and the regulatory and budgetary constraints that most healthcare organisation confront, advanced intelligent assistants in healthcare are unlikely to be widely adopted for decades. Exoskeletons may also be used by nurses to help them transport patients while avoiding back strain. Exoskeletons, in addition to budgetary constraints, take time to put on and set up, so it will be some time before they become a commercial reality in hospitals.

## **5. Conclusion**

In the creation of healthcare robots, modern technologies are particularly effective. Healthcare robots have a bright future ahead of them. At the moment, the most prevalent robot uses in practice are in ageing and assisted living,

where companion robots are used to relieve symptoms and improve patient quality of life. Although there are few examples of healthcare robots in the literature, as more tech-savvy people enter elderly care facilities [1], the possibilities for this type of robot will rise in the coming decades. Researchers and engineers must analyse the needs of clinical regions and create robots to meet those needs. To encourage robotics in personal care and assist patients in selecting the most appropriate form of healthcare technology, engineering concepts must be mastered. Improvements in healthcare robot technology will promote additional developments in nursing robot technology as more healthcare robots are utilized in clinical settings, eventually enhancing nursing care efficiency, quality, and perception.

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### ***Competing Interests Statement***

*The authors declare no competing financial, professional and personal interests.*

### ***Consent for publication***

*Authors declare that they consented for the publication of this research work.*

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